**1. Project**

**Title:** The SPECIAL Modern Pollen Data Set for Climate Reconstructions, version 2 (SMPDSv2)

**Dates:** 2022

**Funding organization**: Funding for the development of the SPECIAL Modern Pollen Data Set for Climate Reconstructions, version 2 (SMPDSv2) was sourced from an ERC-funded project GC2.0 (Global Change 2.0: Unlocking the past for a clearer future, grant: ERC 694481)

**Data contribution**: The following people who contributed data, acknowledge support for data collection:

* [if applicable]

**2. Dataset**

**Title:** The SPECIAL Modern Pollen Data Set for Climate Reconstructions, version 2 (SMPDSv2)

**Summary description:** The dataset contains percentage counts for the [unique\_pollen\_taxa] pollen taxa from individual modern samples from around the world and supporting metadata about each sample. The dataset has been specifically designed for use in quantitative climate reconstructions [other uses].

**Publication year:** 2022

**Creators:** Roberto Villegas-Diaz and Sandy P. Harrison

**Organisation:** Geography and Environmental Science, University of Reading, UK

**Rights Holder:** University of Reading

**3. Terms of use**

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In order to assure traceability, any presentation, report, or publication that uses the SMPDSv2 should cite the dataset (https://doi.org/10.17864/XYZ)

**4. Contents**

**Abstract:** Pollen data are widely used to reconstruct past climate changes, using relationships between modern pollen abundance in surface samples and climate at the surface sample sites. The quality of the reconstructions is strongly influenced by whether the training data set provides an adequate sampling of the climate space. We have assembled modern pollen records from [unique\_number\_of\_sites] terrestrial sites from Europe, Africa, the Middle East, Eurasia, North & South America and Neotropics region, compiled from multiple different published sources and directly from data collectors/authors. The taxonomy was standardised using Plants of the World Online ([www.plantsoftheworldonline.org/](http://www.plantsoftheworldonline.org/)) and the Integrated Taxonomic Information System (<https://www.itis.gov/>). Obligate aquatics, insectivorous plants, cultivated plants and non-native species are not included in the data set, since their distribution is not primarily controlled by climate. Some pollen types have been combined to a higher taxonomic level because they were not routinely identified across all the sites or because they occurred in too few sites to allow the construction of robust relationships with climate. The final list consists of [unique\_pollen\_taxa] taxa (Table 2). The pollen data were transformed from raw counts to relative abundance, based on a pollen sum that includes all the taxa in the assemblage.

**Access to the SMPDSv2:** The SMPDSv2 is stored as a MySQL database file ("smpdsv2.sql"). Please check https://dev.mysql.com/downloads/ to download and install MySQL. Once MySQL Community Server and MySQL Workbench (or any other database client of your preference) are installed, the database can be imported and visualised. A schema must be created upon import. To import the SQL file, you follow:

1. Open MySQL Workbench

2. Connect to the connection you would like to store your database in. A connection is usually created during the installation process (usually root@localhost with the password defined during the installation process)

3. Server > Data Import > Import from Self-contained file

4. Browse to the SQL file you have downloaded

5. Press New, next to the default target schema to create a new schema (name this as appropriate: e.g. SMPDSv2)

6. Press Import

**File structure:** The data are stored in a relational database (MySQL), which consists of 4 linked tables, specifically: "entity", "climate", "taxon\_name" and "pollen\_count". The database is also stored as 4 flat CSV files:

* "smpdsv2\_metadata.csv": combines the "entity" and "climate" tables
* "smpdsv2\_pollen\_counts\_clean.csv": contains the clean version of the pollen counts, where each row represents the samples and the columns are: ID\_SAMPLE, taxon1, taxon2, …, taxonk
* "smpdsv2\_pollen\_counts\_intermediate.csv": contains the intermediate version of the pollen counts, where each row represents the samples and the columns are: ID\_SAMPLE, taxon1, taxon2, …, taxonm
* "smpdsv2\_pollen\_counts\_amalgamated.csv": contains the amalgamated version of the pollen counts, where each row represents the samples and the columns are: ID\_SAMPLE, taxon1, taxon2, …, taxonn

As these are flat CSV files, no relationships are defined here but the tables can be joined using different programming languages (R, Python, etc.) based on the foreign keys (shared column names between tables such as ID\_ SAMPLE in the metadata and files with pollen counts). The different fields included in the database are summarised in Table 1. Table 2 provides a list of the taxa.

Additionally, a companion R data package has been created and can be found at <https://github.com/special-uor/smpds>. This package contains the 4 tables in the database, as well as a set of utilitarian functions to generate plots and create climate reconstructions.

**5. References**

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Description automatically generated

*Figure 1. Entity-relation diagram showing the structure of the database, each individual table, their attributes, and relationships are shown. One-to-many relations indicate that is possible for several entities in one table to be linked to a single record in another table (e.g. the same taxon\_name can be represented in many pollen\_count records, for different samples). The database uses foreign keys (FK) to allow for such linkages.*

*Table 1. Summary of the different fields in the SMPDSv2 and the tables in which they are found.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Table** | **Field name** | **Definition** | **Format** |
| entity | ID\_SITE | Unique identifier for each site. A site can have multiple entities. | Unsigned integer |
| entity | ID\_ENTITY | Unique identifier for each entity. An entity can have multiple samples at different depths. | Unsigned integer |
| entity, climate, pollen\_count | ID\_SAMPLE | Unique identifier for each sample | Unsigned integer |
| entity | source | Source from which the data was repatriated (e.g. Neotoma, EMPDv2) | Text |
| entity | site\_name | Site name as given by original authors or as defined by us where there was no unique name given to the site | Text |
| entity | entity\_name | Name of entity, where an entity may be a separate core from the same site or an alternative measurement type of the same core. | Text |
| entity | latitude | Latitude of the sampling site, given in decimal degrees, where N is positive and S is negative | Double precision number |
| entity | longitude | Longitude of the sampling site in decimal degrees, where E is positive and W is negative | Double precision number |
| entity | elevation | Elevation of the sampling site in metres above (+) or below (-) sea level | Double precision number |
| entity | basin\_size | Size of sampled site (e.g. lake, bog, etc.) in km2 or given as a categorical estimated when precise information was not recorded or was not available | Text |
| entity | site\_type | Information about type of site (e.g. cave, lake, glacial, terrestrial, etc.) | Text |
| entity | entity\_type | Information about the type of entity (e.g. composite, core top, surface sample, etc.) | Text |
| entity | age\_BP | Sample age in years before present (BP) or categorical estimated where not numeric values were available | Text |
| entity | publication | Citation for the publication where the data was originally published | Text |
| entity | doi | Digital Object Identifier (DOI) for the publication | Text |
| climate | ID\_BIOME | Unique identifier for each potential natural vegetation (PNV) | Unsigned integer |
| climate | PNV | Potential Natural Vegetation based on the work by Hengl et al., 2018 | Text |
| climate | mi | Reconstructed Moisture Index [unitless] using the CRU TS 4.04 (Harris et al., 2020) data set | Double precision number |
| climate | gdd0 | Reconstructed Growing Degree Days above 0 ºC [ºC days] using the CRU TS 4.04 (Harris et al., 2020) data set | Double precision number |
| climate | mat | Reconstructed Mean Annual Temperature [ºC] using the CRU TS 4.04 (Harris et al., 2020) data set | Double precision number |
| climate | mtco | Reconstructed Mean Temperature of the Coldest Month [ºC] using the CRU TS 4.04 (Harris et al., 2020) data set | Double precision number |
| climate | mtwa | Reconstructed Mean Temperature of the Warmest Month [ºC] using the CRU TS 4.04 (Harris et al., 2020) data set | Double precision number |
| climate | map | Reconstructed Mean Annual Precipitation [mm/year] using the CRU TS 4.04 (Harris et al., 2020) data set | Double precision number |
| taxon\_name,  pollen\_count | ID\_TAXON | Unique identifier for each taxon | Unsigned integer |
| taxon\_name | taxon\_name | Standardised taxon name | Text |
| pollen\_count | amalgamation\_level | Level of amalgamation for the pollen counts:   * amalgamation\_level = 0:   clean pollen counts   * amalgamation\_level = 1:   intermediate pollen counts   * amalgamation\_level = 2:   amalgamated pollen counts | Unsigned integer between 0 and 2 |
| pollen\_count | count | Standardised pollen count | Double precision number |

Table 2: List of pollen taxa.

|  |
| --- |
| Abies |

[to be included after SPH’s inspections are implemented]